



# EFFECT OF STRENGTH TRAINING AND ENDURANCE TRAINING ON SELECTED PHYSICAL FITNESS VARIABLES

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## ABSTRACT

The purpose of the study was to find out the effect of resistance training and endurance training on selected physical fitness variables. Forty five female students aged between 17 and 22 years were selected for the study. They were divided into three equal groups, each group consisting of fifteen subjects in which three experimental groups and one control group, in which the group I (n=15) underwent resistance training, group II (n = 15) underwent endurance training for three days (alternative days) per week for twelve weeks, and group III (n=15) acted as control, which did not participate in any training. The subjects were tested on selected criterion variables such as leg strength, strength endurance and cardio-respiratory endurance at prior to and immediately after the training period. For testing the leg strength, the dynamometer was used, to test the strength endurance, bent knee sit-ups was administered and to measure the cardio-respiratory endurance, Cooper's 12 minutes run/walk test was administered. The analysis of covariance (ANCOVA) was used to find out the significant difference if any, between the experimental groups and control group on selected criterion variables separately. Since there were three groups involved in the present study, the Scheffé S test was used as post-hoc test. The selected criterion variables such as leg strength, strength endurance and cardio-respiratory were improved significantly for the training groups when compared with the control group and the leg strength and strength endurance were improved significantly for strength training group and in cardio-respiratory endurance, the endurance training group was improved significantly.

**KEY WORDS:** Resistance training, endurance training, physical fitness, leg strength, strength endurance and cardio-respiratory endurance.

## INTRODUCTION:

Physical training is focuses on mechanistic goals. The overall muscles and some specific skill will develop within particular period of time after the physical training. Physical fitness will be improved by the most of the physical training programme.<sup>[1]</sup> Dale S. Beach<sup>[2]</sup> defines training as 'the organized procedure by which people learn knowledge and/or skill for a definite purpose'. It is a process of teaching of particular skill to somebody, either human or animal and the aim is to improve the capacity, performance capacity or productivity of an individual.<sup>[3]</sup>

Physical training is the most important ingredient to achieve high level of performance of athlete. It's objectives are to increase the highest standards of an athletes' physiological potential and biomotor abilities.<sup>[4]</sup> Physical training should be given to the athlete on the basis of scientific principles and which, through systematic development of mental and physical efficiency, capacity and motivation, which help the athlete to produce outstanding and record breaking performances.<sup>[5]</sup>

During a specific period of time, an organized training which involves increasing cycle of training programme which enhance the performance of an individual is called as periodization.<sup>[6]</sup> During the periodization, the competitor gets optimum adaptation before an important event. Instead of performing the regular routing workouts month after month, the athlete change his or her program with regular periods or interval to work harder with adequate rest.<sup>[7]</sup> A study was conducted at Human Performance Laboratory, Ball State University shown that there was a significant improvement in muscular performance was found in favour of periodized strength training programme than the non-periodized program.<sup>[8]</sup>

The strength training also refers as a type of physical exercise, uses of resistance which enhance the muscular contraction which contributes the strength, increase the size of skeletal muscle and anaerobic endurance. It can improve the overall health and well-being, including the size of muscle, tendon, strengthen and improves the toughness of ligament and joint function, reduced for injury<sup>[9]</sup> increased the bone density, fitness, metabolism and cardiac function.<sup>[10,11]</sup>

Training the aerobic system is called as endurance training which is opposed to the anaerobic system, which is divided into two categories, general and specific endurance.<sup>[12]</sup> Endurance fitness which sustain the necessary activity level for a specific competitive sport, which includes both cardiovascular and strength endurance required for the sport.<sup>[13]</sup> In physiological aspect, it requires the circulatory and respiratory systems to supply energy to the working muscles to support sustained physical activity. Endurance requires the circulatory and respiratory systems to supply energy to the working muscles in order to support sustained physical activity.<sup>[14]</sup>

## MATERIALS AND METHODS:

In this study it was aimed to find out the effect of resistance training, and endurance training on leg strength, strength endurance and cardio-respiratory endurance. To achieve the purpose forty five female students from various faculties of Annamalai University, Annamalainagar, Tamilnadu were selected as subjects at random from the total population of 143 students. They were divided into three equal groups of fifteen each and further divided as two experimental groups and one control group, in which the group I (n=15) underwent resistance training, group II (n = 15) underwent endurance training for three days (alternative days) per week for twelve weeks, and group III (n=15) acted as control which did not participate in any special training apart from the regular curricular activities.

For every training programme there would be a change in various structure and systems in human body. So, the researchers consulted with the experts and then selected the following variables as criterion variables: 1. Leg strength, 2. Strength endurance and 3. Cardio-respiratory endurance.

## Analysis of the Data:

Analysis of covariance was used to determine the differences, if any, among the adjusted post test means on selected criterion variables separately. Whenever the 'F' ratio for adjusted post test mean was found to be significant, the Scheffé S test was applied as post-hoc test. The level of significance was fixed at .05 level of confidence to test the 'F' ratio obtained by analysis of covariance.

**Table I: Analysis of Covariance and 'F' ratio for Leg Strength, Strength Endurance and Cardio-respiratory Endurance of Resistance Training Group, Endurance Training Group and Control Group**

Variable Name	Group Name	Resistance Training Group	Endurance Training Group	Control Group	'F' Ratio
Leg Strength (in Kgs.)	Pre-test Mean $\pm$ S.D.	37.40 $\pm$ 3.02	37.60 $\pm$ 4.36	38.80 $\pm$ 4.55	0.53
	Post-test Mean $\pm$ S.D.	41.80 $\pm$ 2.96	41.33 $\pm$ 3.42	38.49 $\pm$ 4.32	4.08*
	Adj. Post-test Mean	42.204	41.586	37.3676	23.20*
Strength Endurance (in Numbers / min)	Pre-test Mean $\pm$ S.D.	21.07 $\pm$ 3.82	21.67 $\pm$ 2.19	21.13 $\pm$ 2.39	0.194
	Post-test Mean $\pm$ S.D.	24.47 $\pm$ 3.67	22.93 $\pm$ 3.85	19.80 $\pm$ 2.76	7.11*
	Adj. Post-test Mean	24.652	22.618	19.930	13.47*

Variable Name	Group Name	Resistance Training Group	Endurance Training Group	Control Group	'F' Ratio
Cardio-respiratory Endurance (in Meters)	Pre-test Mean $\pm$ S.D.	1069.33 $\pm$ 129	1082.33 $\pm$ 95.04	1052.7 $\pm$ 74.7	0.32
	Post-test Mean $\pm$ S.D.	1144.33 $\pm$ 140	1290.67 $\pm$ 105.8	1030.3 $\pm$ 81.3	20.44*
	Adj. Post-test Mean	1143.32	1277.93	1045.10	62.02*

\* Significant at .05 level of confidence. (The table value required for significance at .05 level of confidence with df 2 and 42 and 2 and 41 were 3.22 and 3.23 respectively).

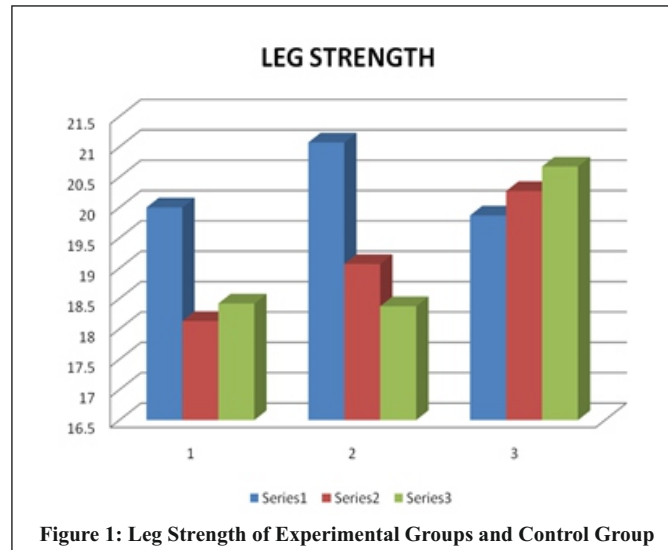


Figure 1: Leg Strength of Experimental Groups and Control Group

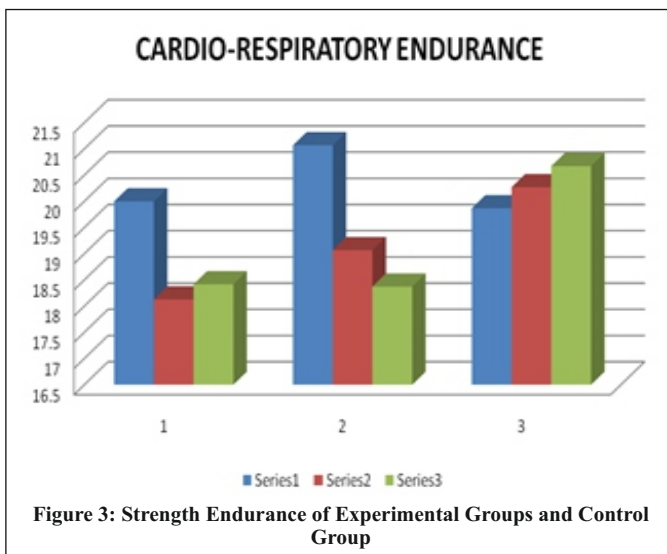


Figure 3: Strength Endurance of Experimental Groups and Control Group

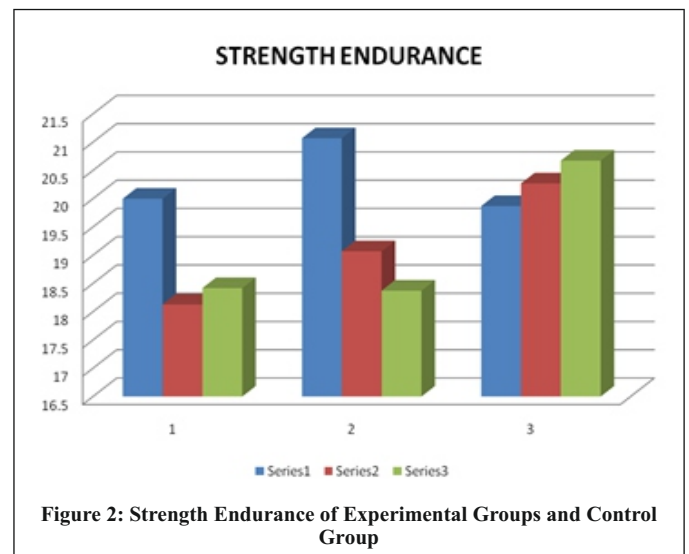


Figure 2: Strength Endurance of Experimental Groups and Control Group

#### Results - I:

Table - I shows that pre and post test means 'f' ratio of resistance training group, endurance training group and control group on leg strength was 0.53, which is insignificant at 0.05 level of confidence. The post and adjusted post test mean 'f' ratio value of experimental groups and control group was 4.08 and 23.20 which was significant at 0.05 level of confidence. The pre test means 'f' ratio of resistance training group, endurance training group and control group on strength endurance was 0.194, which is insignificant at 0.05 level of confidence. The post and adjusted post test mean 'f' ratio value of experimental groups and control group was 7.11 and 13.47, which was significant at 0.05

level of confidence. The pre test means 'f' ratio of resistance training group, endurance training group and control group on cardio-respiratory endurance were 0.32 which is insignificant at 0.05 level of confidence. The post test and adjusted post test mean 'f' ratio value of experimental groups and control group were 20.44 and 62.02, which was significant at 0.05 level of confidence. The overall study shows that there was a significant increase in leg strength, strength endurance and cardio-respiratory endurance. Further, to find out which of the paired mean significantly differ, the Scheffé S test was applied and presented below.

Table II: Scheffé S Test for the Difference Between the Adjusted Post-Test Mean of Leg Strength, Strength Endurance and Cardio-respiratory Endurance

Resistance Training Group	Endurance Training Group	Control Group	Mean Difference	Confidence Interval at 0.05 level
Adjusted Post-test Mean Difference on Leg Strength				
42.204		37.676	4.528*	1.81
42.204	41.586		0.618	1.81
	41.586	37.676	3.91*	1.81

Resistance Training Group	Endurance Training Group	Control Group	Mean Difference	Confidence Interval at 0.05 level
<b>Adjusted Post-test Mean Difference on Strength Endurance</b>				
24.652		19.930	4.722*	2.32
24.652	22.618		2.034	2.32
	22.618	19.930	2.688*	2.32
<b>Adjusted Post-test Mean Difference on Cardio-respiratory Endurance</b>				
1210.22	1433.86		223.64*	28.1677
1210.22		1054.23	155.99*	28.1677
	1433.86	1054.23	379.99*	28.1677

\*Significant at 0.05 level of confidence.

## RESULTS - II:

Table – II shows that the Scheffé S Test for the difference between adjusted post-test mean of resistance training group and control group (4.528) and endurance training group and control group (3.91) which were significant at 0.05 level of confidence. But there was no significant difference between resistance training group and endurance training group (0.618) on leg strength after the respective training programme.

Table – II also shows that the Scheffé S Test for the difference between adjusted post-test mean difference in strength endurance between resistance training group and control group (4.722) and endurance training group and control group (2.688) were significant at 0.05 level of confidence. But there was no significant difference between resistance training group and endurance training group (2.034) on strength endurance.

Table – II shows that the Scheffé S Test for the difference between adjusted post-test mean difference in cardio-respiratory endurance between resistance training group and control group (223.64), resistance training group and endurance training group (155.99) and endurance training group and control group (37.99) were significant at 0.05 level of confidence in favour of endurance training group.

## CONCLUSIONS:

The result of the present study shows that the leg strength has improved all the training groups except, endurance training group. Findings of Kaukab Azeem and Ameer[15] K. Spanos et al, [16] and W.J. Kraemer et al [17] found that there was a significant improvement in leg strength after 24 weeks whole body vibration and standard fitness training programme (strength and cardio-vascular training). In Manikandan [18] and Mathankumar and Sakthignanavel [19] found that there was a significant improvement in cardio-respiratory endurance after the continuous running.

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